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Hupf et al.

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[45] **Date of Patent: Dec. 21, 1999**

[54] **TEMPERATURE INDICATING DEVICE FOR A COOKING VESSEL**

[75] Inventors: **Charles J. Hupf**, Cascade; **Karlis Arijis Smaga**, Hartford, both of Wis.

[73] Assignee: **Regal Ware, Inc.**, Kewaskum, Wis.

[21] Appl. No.: **08/943,947**

[22] Filed: **Oct. 3, 1997**

Related U.S. Application Data

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[51] **Int. Cl.**[6] **G01D 11/28**

[52] **U.S. Cl.** **362/26**; 99/343; 116/70; 362/154

[58] **Field of Search** 116/70; 362/26, 362/27, 32, 92, 154, 234, 253; 99/338, 343

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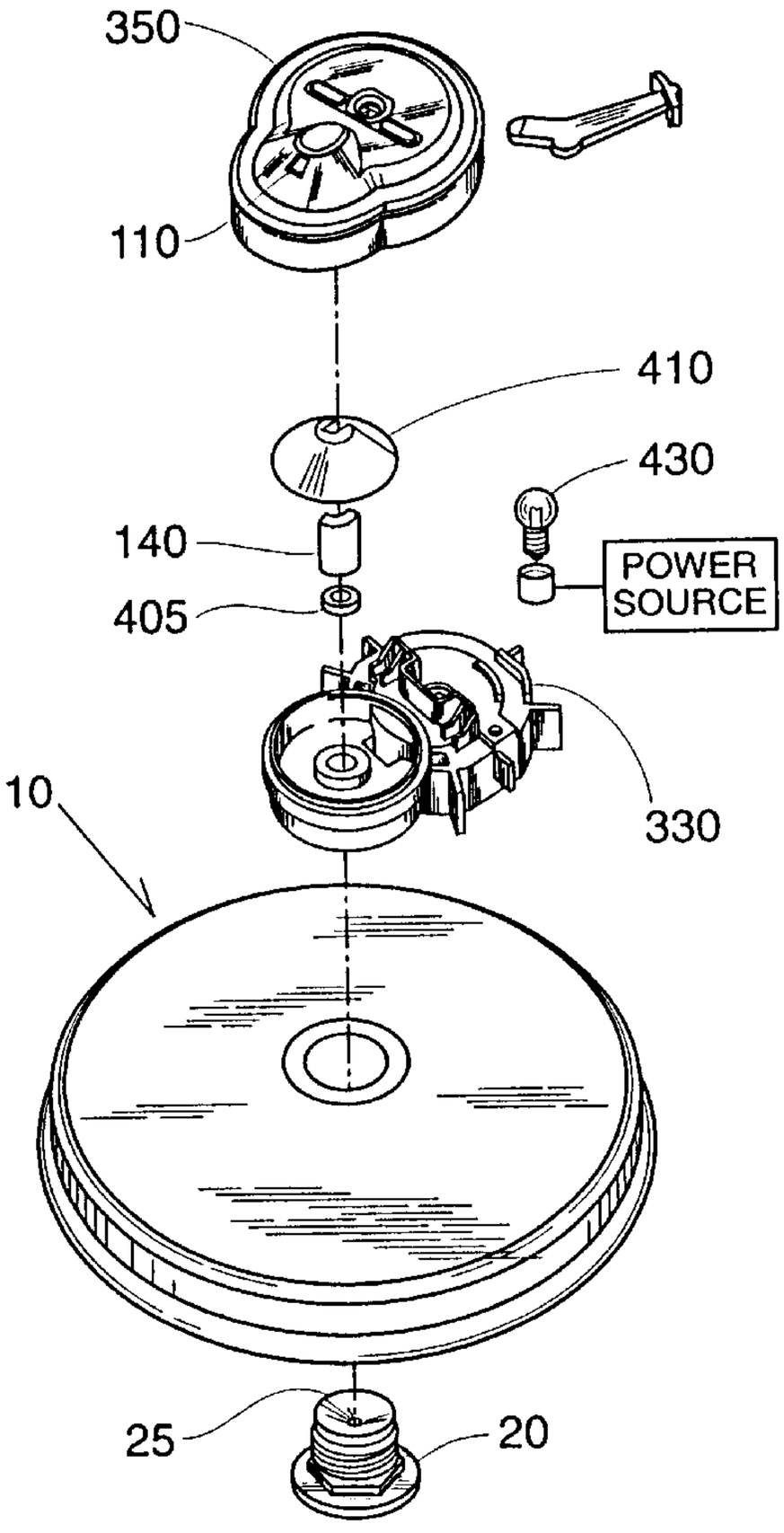
Primary Examiner—Stephen Husar

Attorney, Agent, or Firm—Ryan Kromholz & Manion, S.C.

[57] **ABSTRACT**

A temperature indicating apparatus for a cooking vessel, the apparatus having a housing having at least one opening, a template, a light directing mechanism, and a temperature sensing mechanism. The template being positioned generally in alignment with the opening. The light directing mechanism having a light radiating structure positioned to illuminate the template. The template being moveably coupled to the temperature sensing mechanism. The light directing mechanism being coupled to the housing. A process for monitoring the temperature of a cooking vessel including a temperature indicating apparatus for a cooking vessel, the apparatus having a housing having at least one opening, a template or translucent panel or both, a light directing mechanism, and a temperature sensing mechanism is also described.

15 Claims, 9 Drawing Sheets



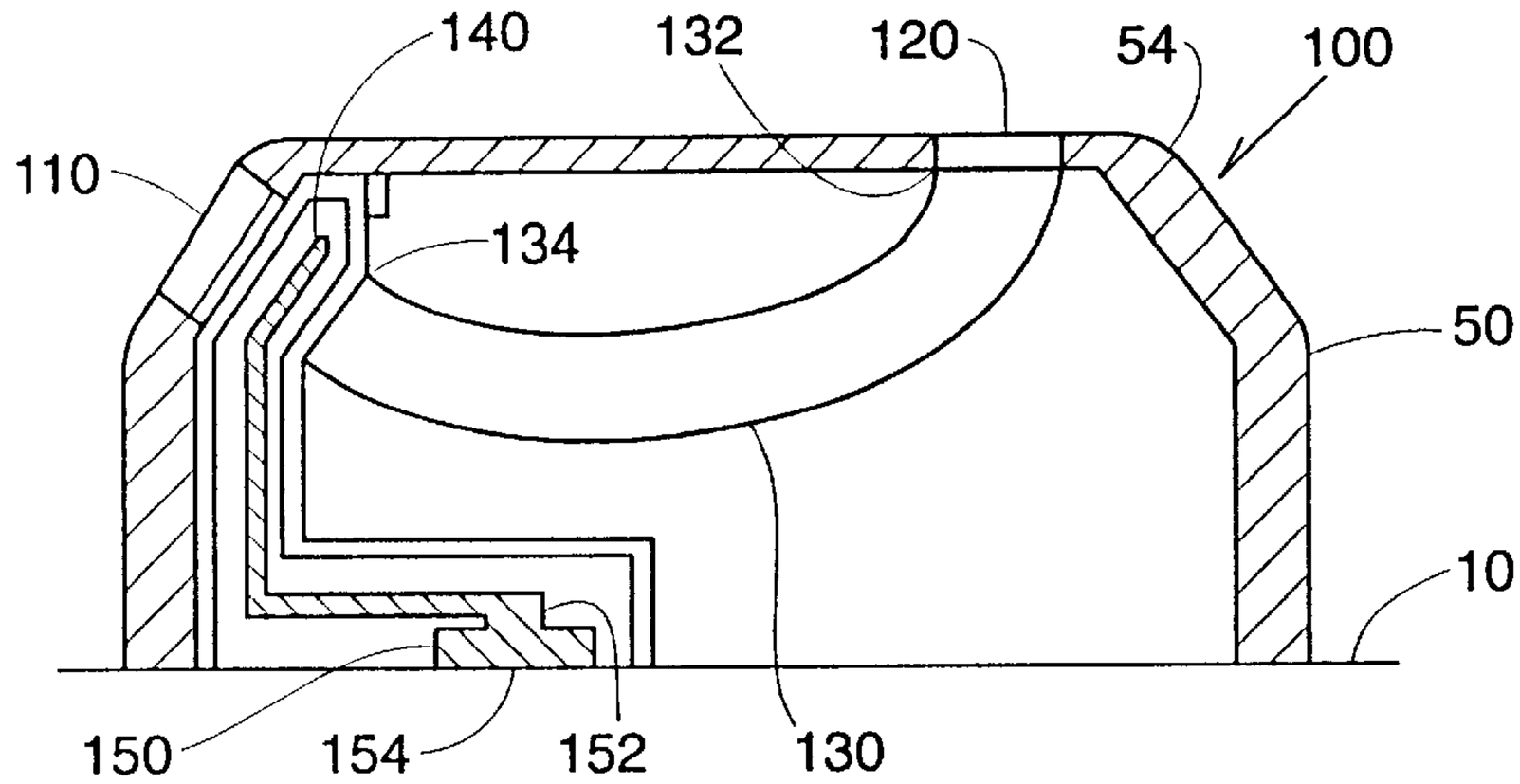


FIG. 1

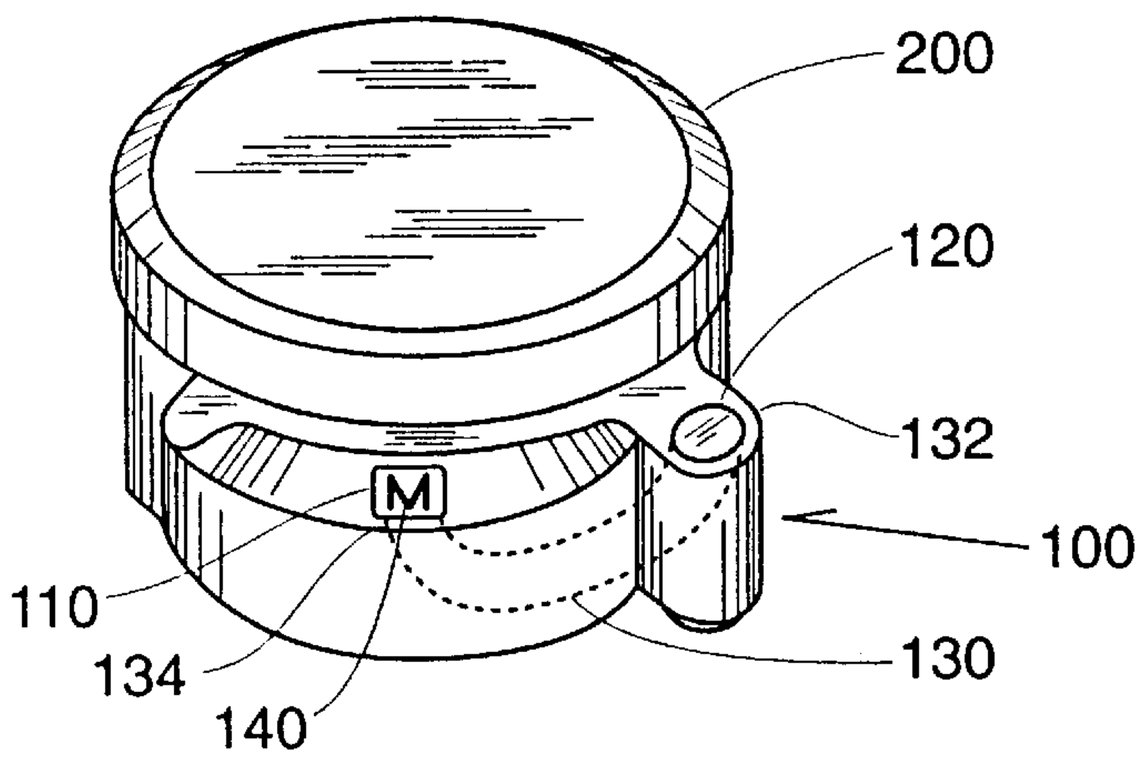


FIG. 3

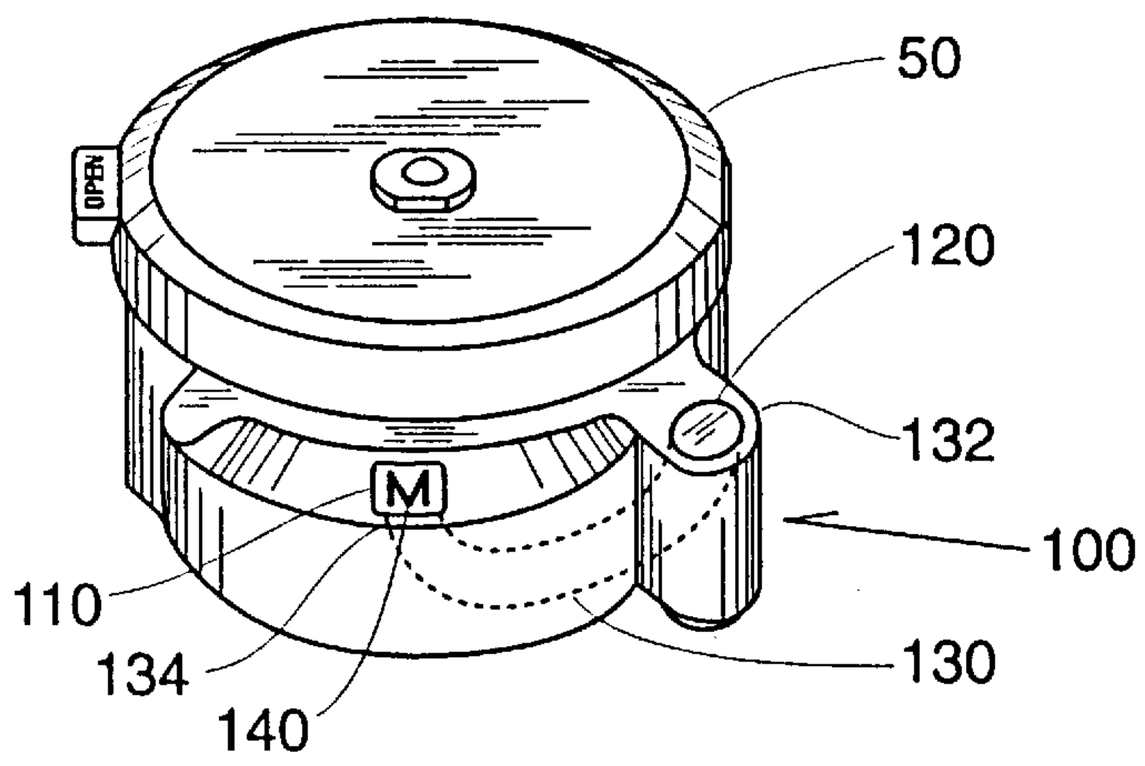


FIG. 4

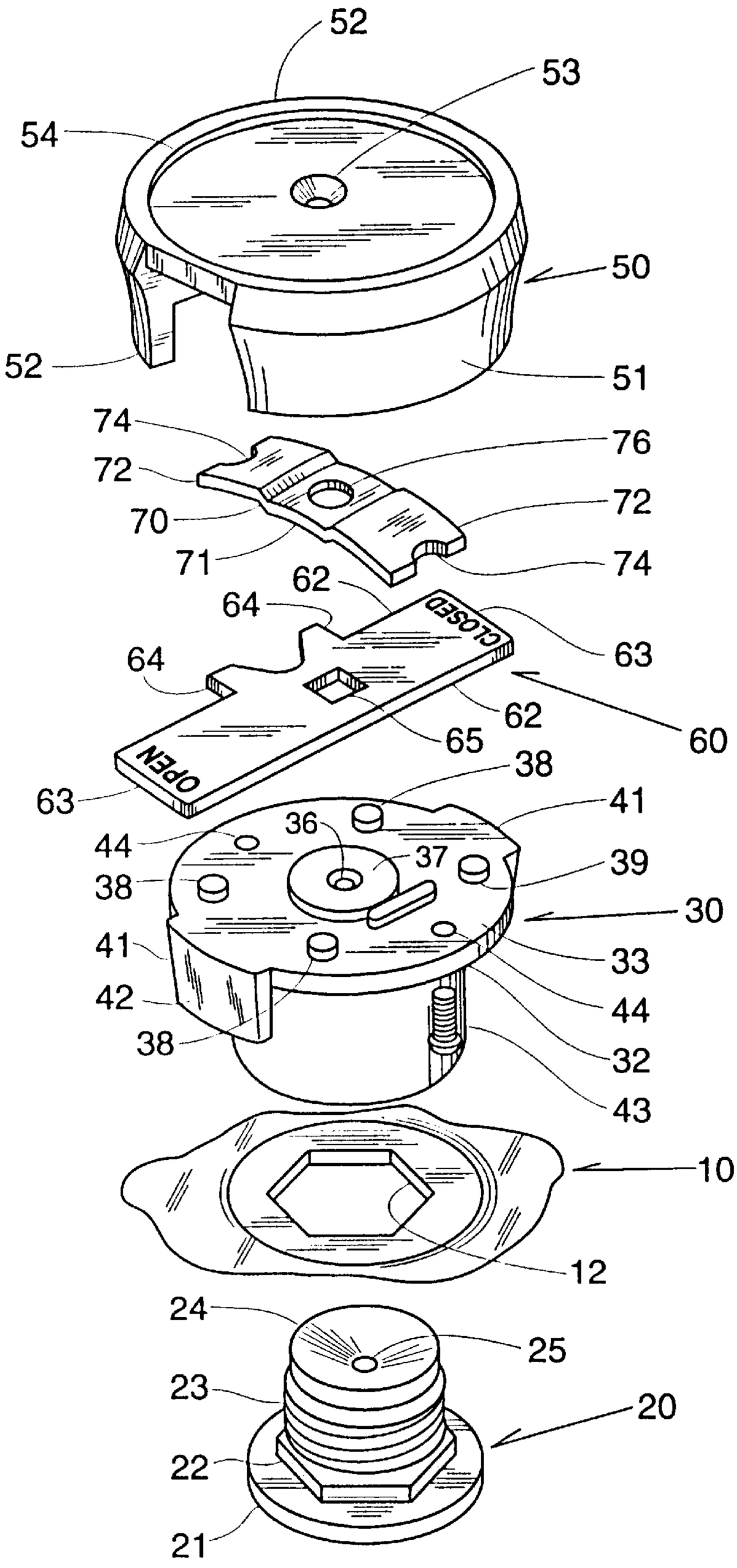

52
53
54
50
52
51
74
76
72
72
70
74
71
62
64
CLOSED
63
64
62
65
60
OPEN
63
38
41
36
44
37
39
38
30
41
33
44
42
32
38
43
10
12
24
25
23
20
22
21

FIG. 2 (OLD ART)

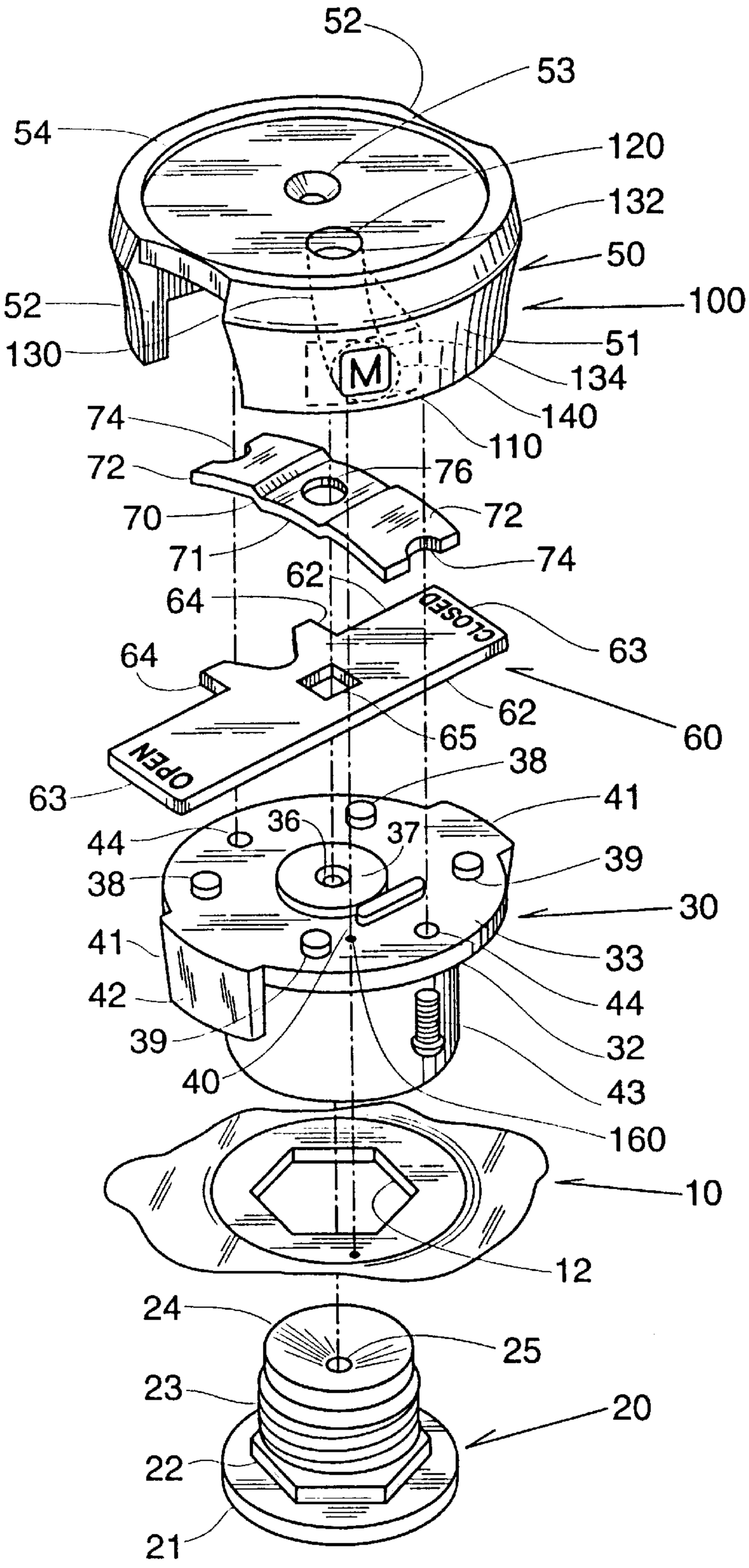

52
53
54
120
132
50
52
100
130
51
M
134
140
74
110
72
76
70
72
71
74
62
64
CLOSED
63
64
62
65
60
OPEN
38
63
41
36
37
44
39
38
30
41
33
42
44
39
32
40
43
160
10
12
24
25
23
20
22
21

FIG. 2A

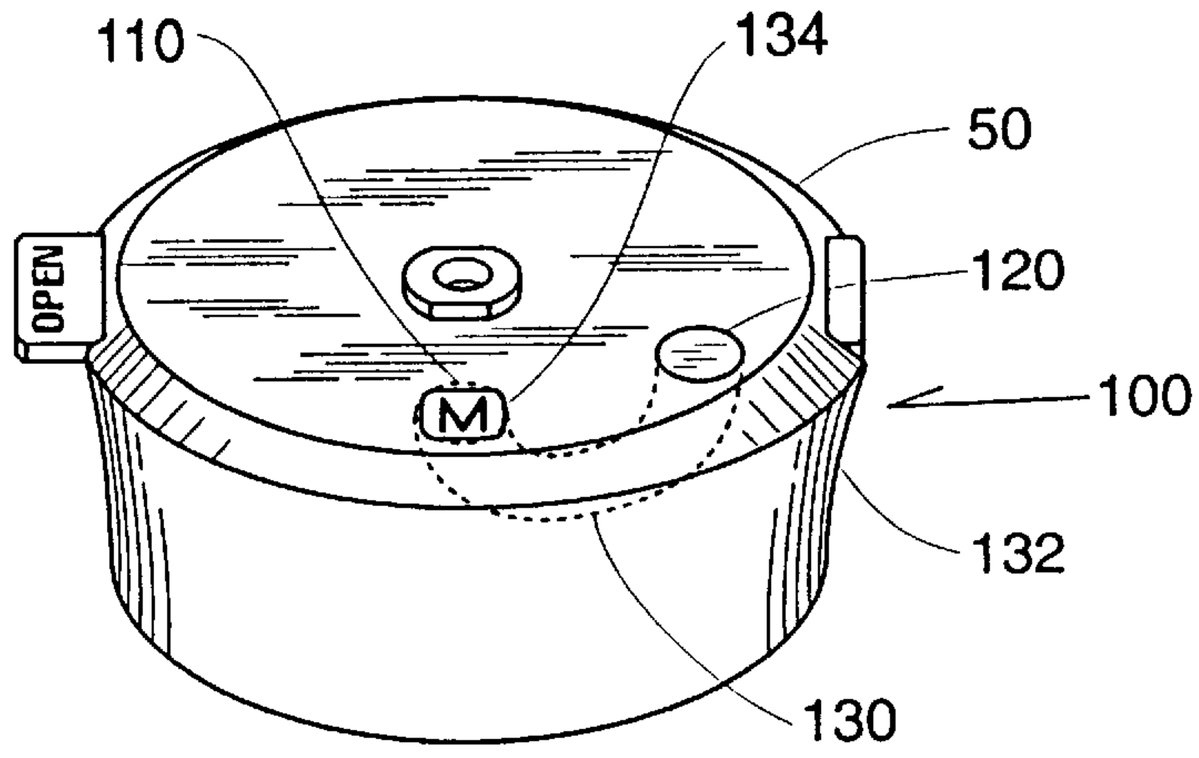

110
134
50
OPEN
120
M
100
132
130

FIG. 5

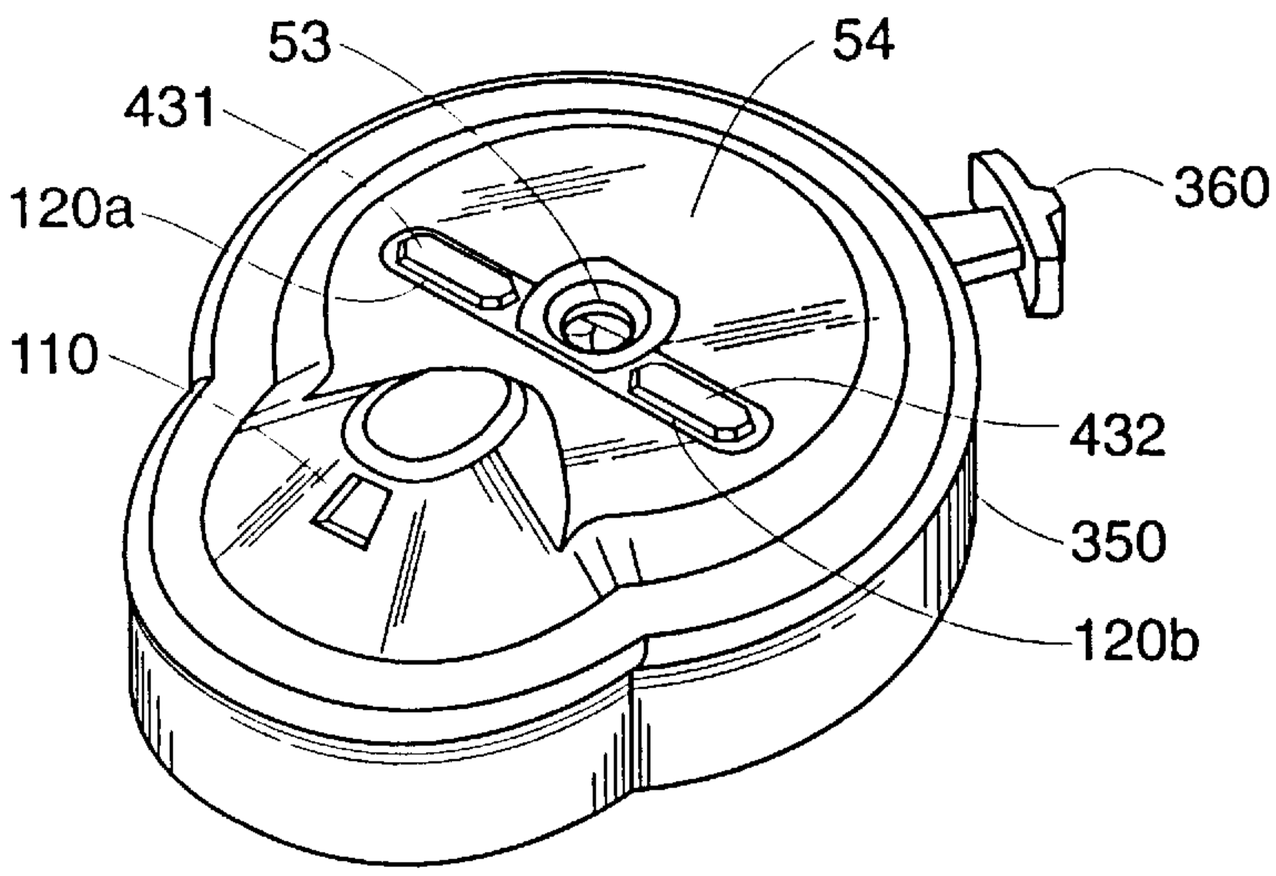

53
54
431
360
120a
110
432
350
120b

FIG. 6

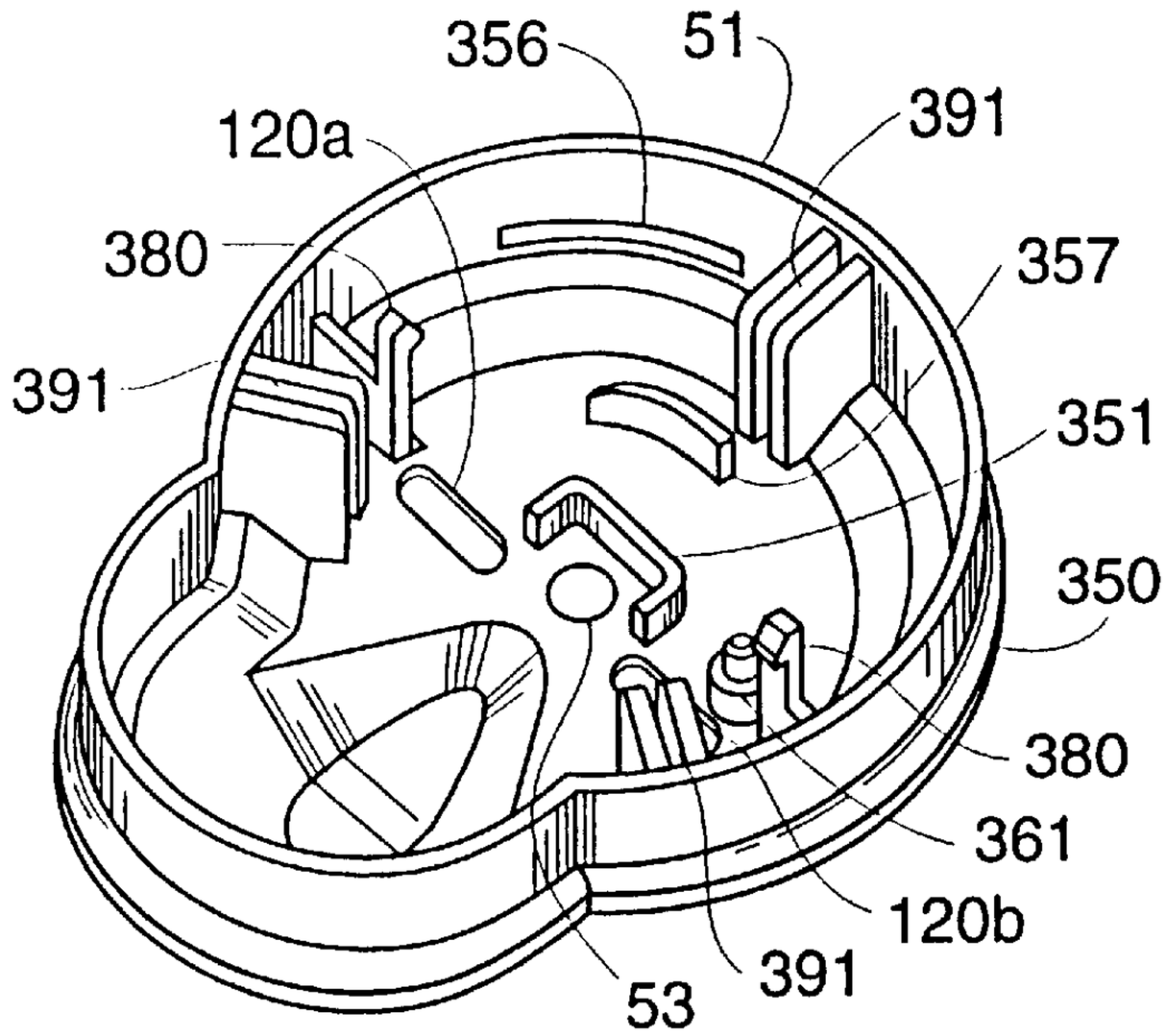

356
51
120a
391
380
357
391
351
350
380
361
120b
391
53

FIG. 7

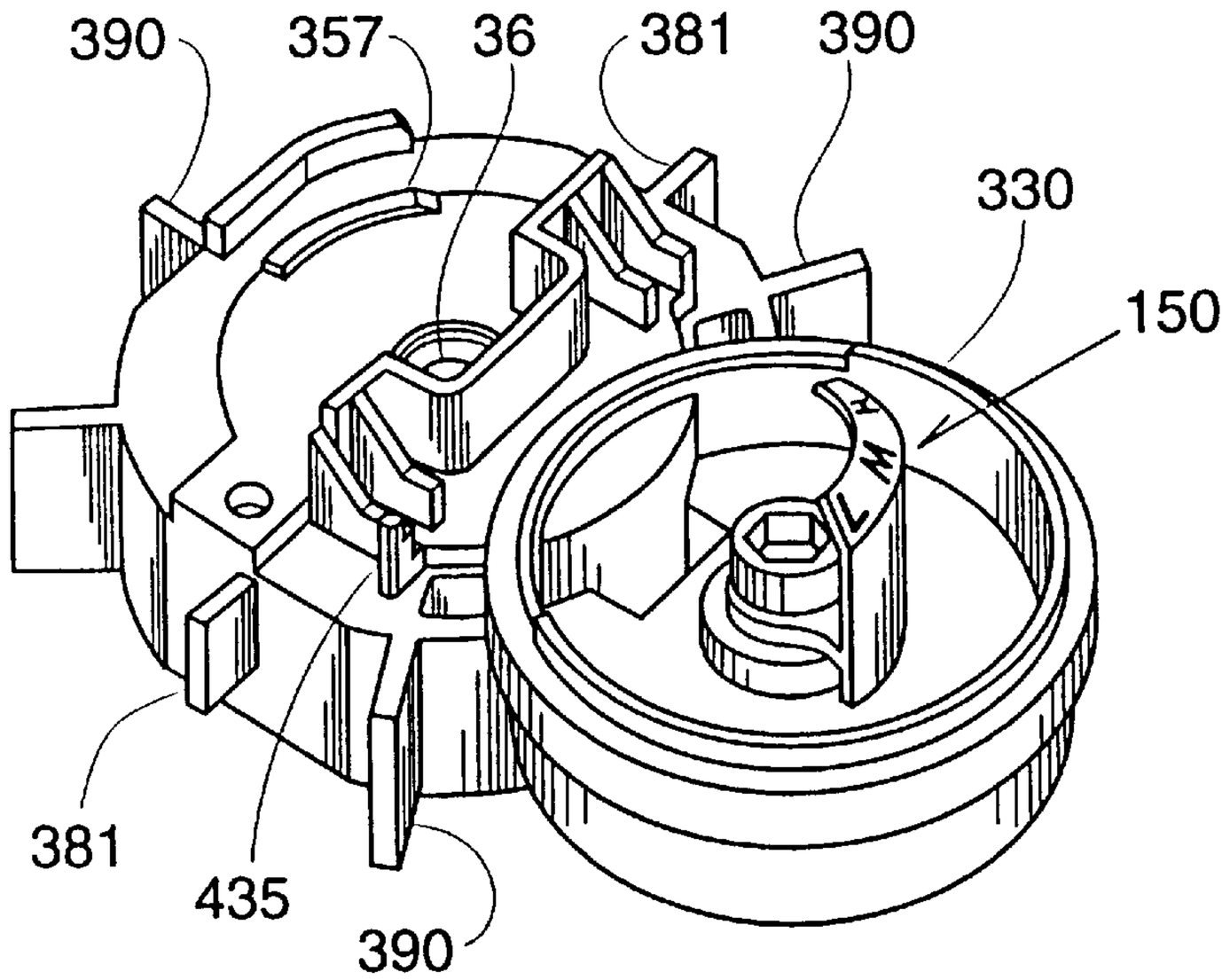

390
357
36
381
390
330
150
381
435
390

FIG. 8

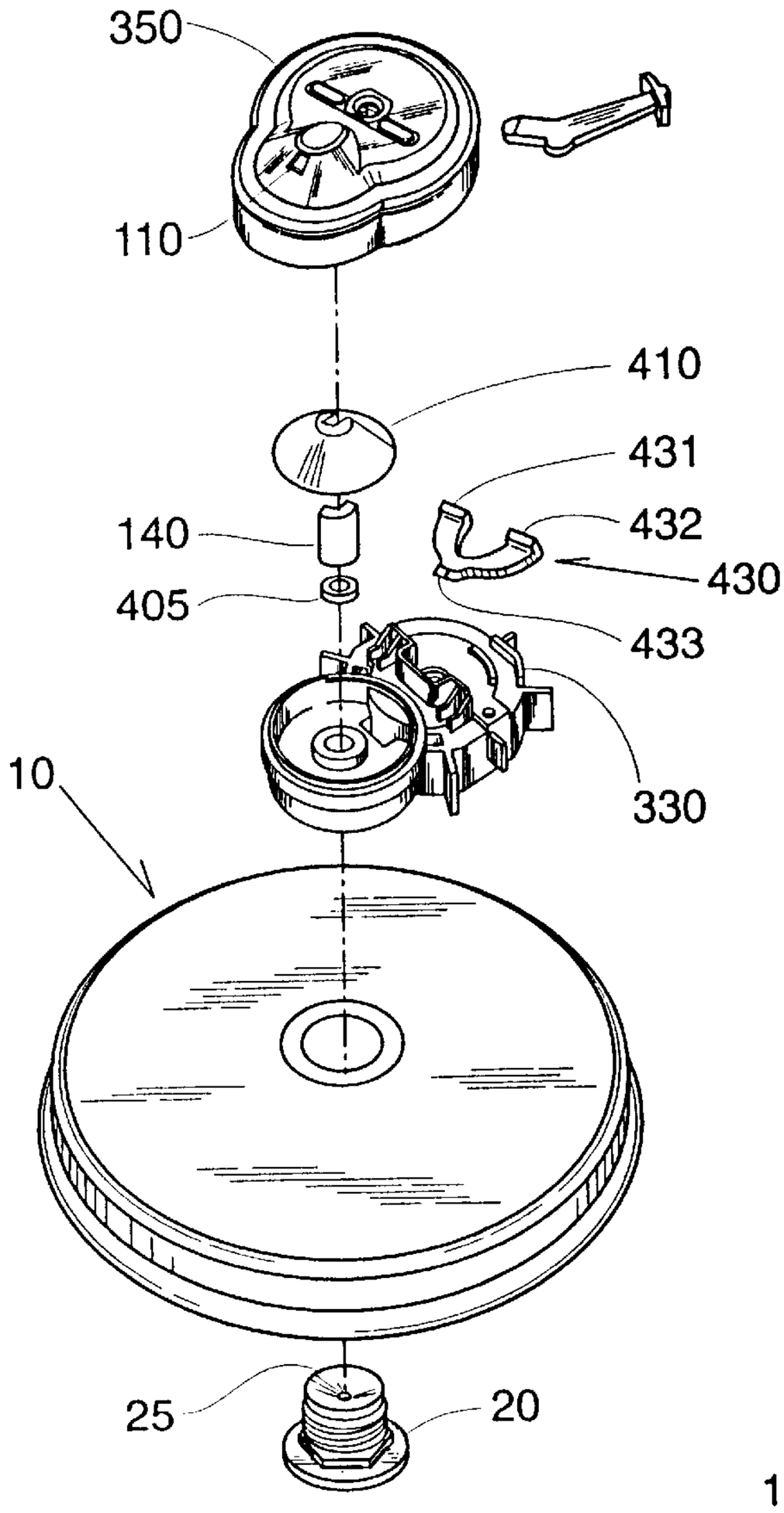

350
110
410
431
140
432
430
405
433
330
10
25
20

FIG. 9

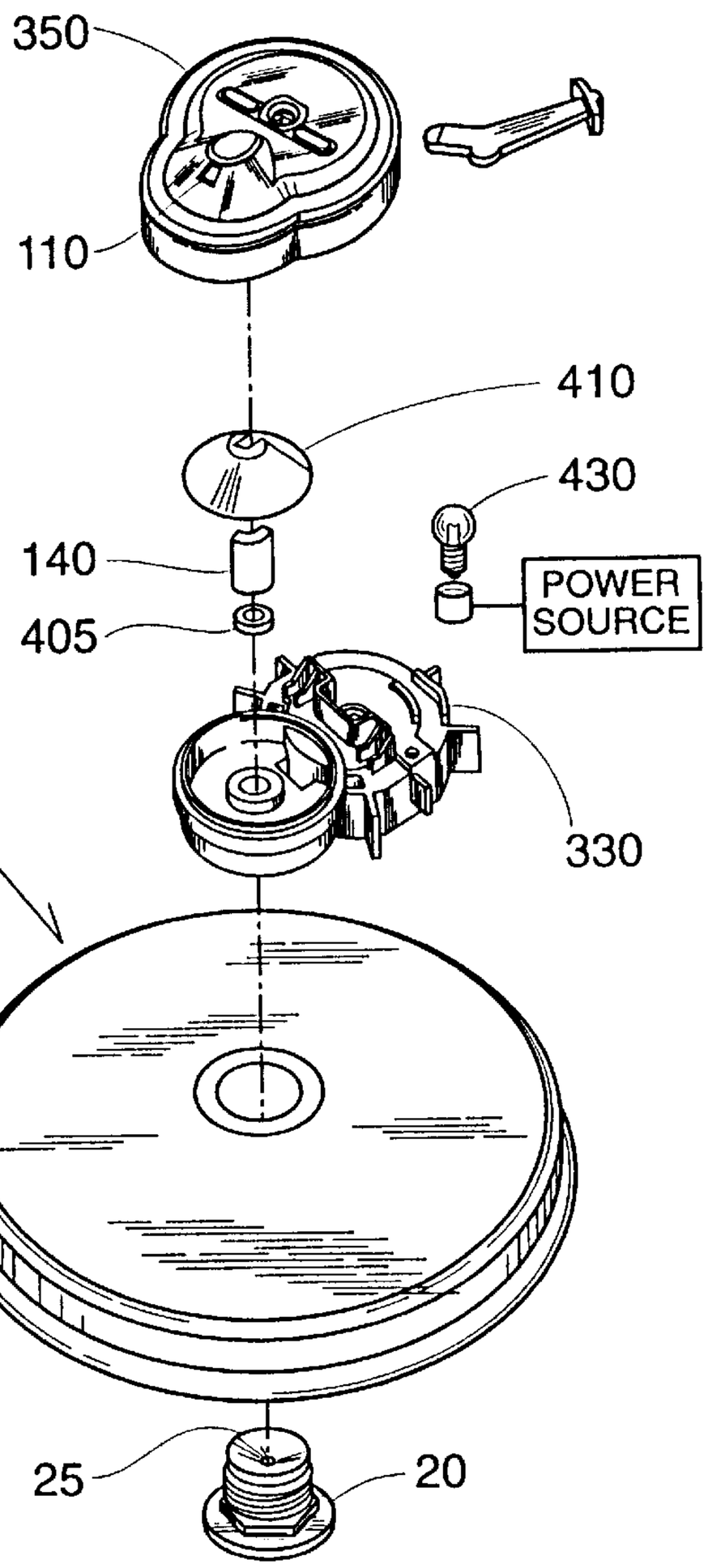

350
110
410
430
140
POWER SOURCE
405
330
10
25
20

FIG. 9A

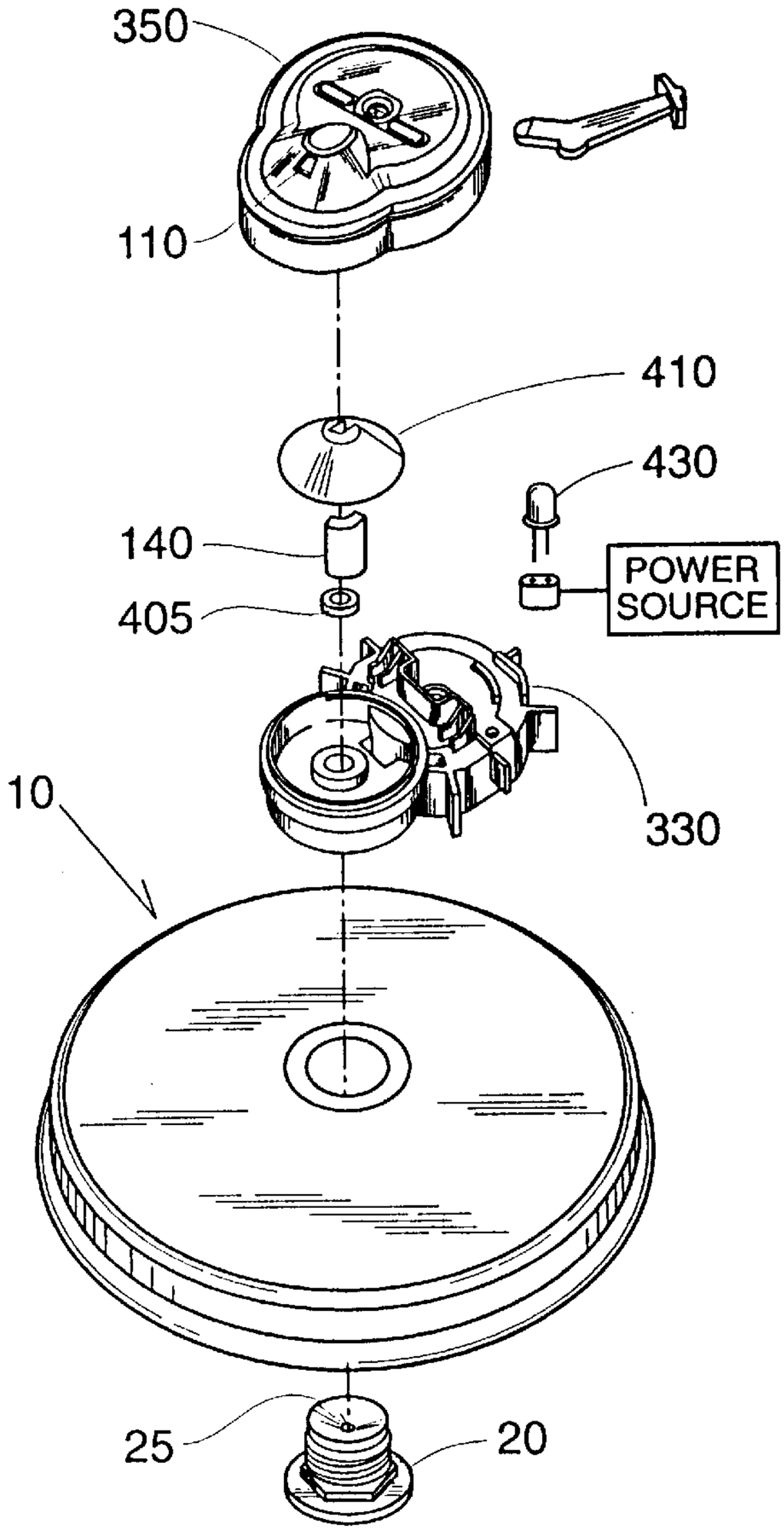


FIG. 9B

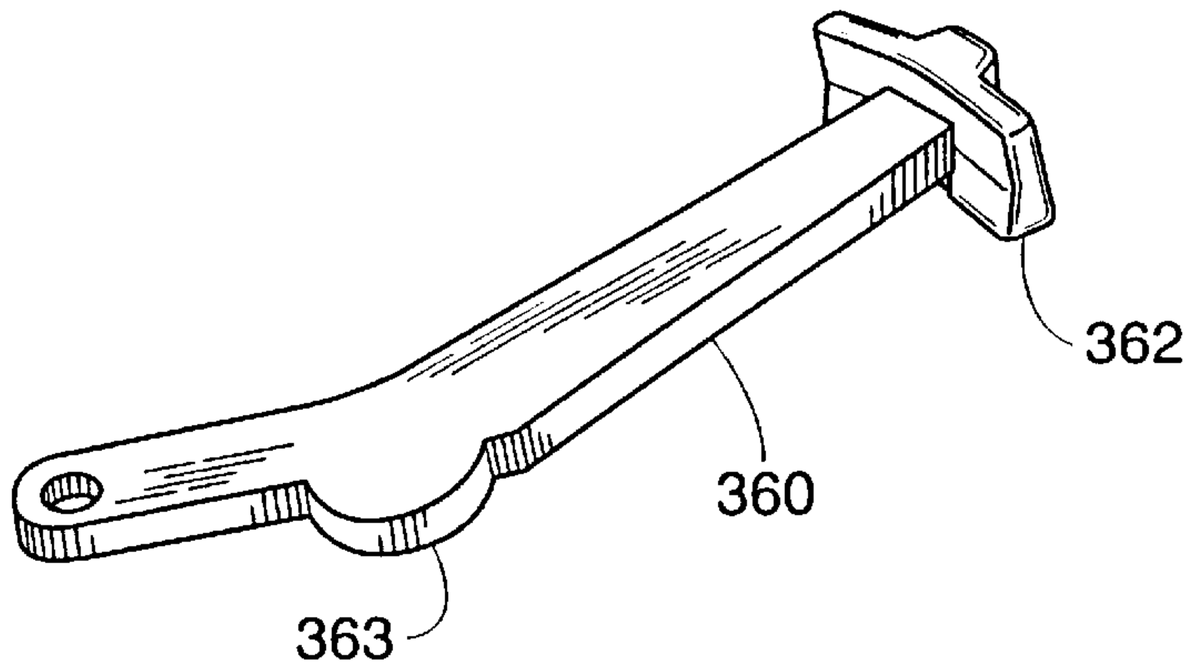


FIG. 10

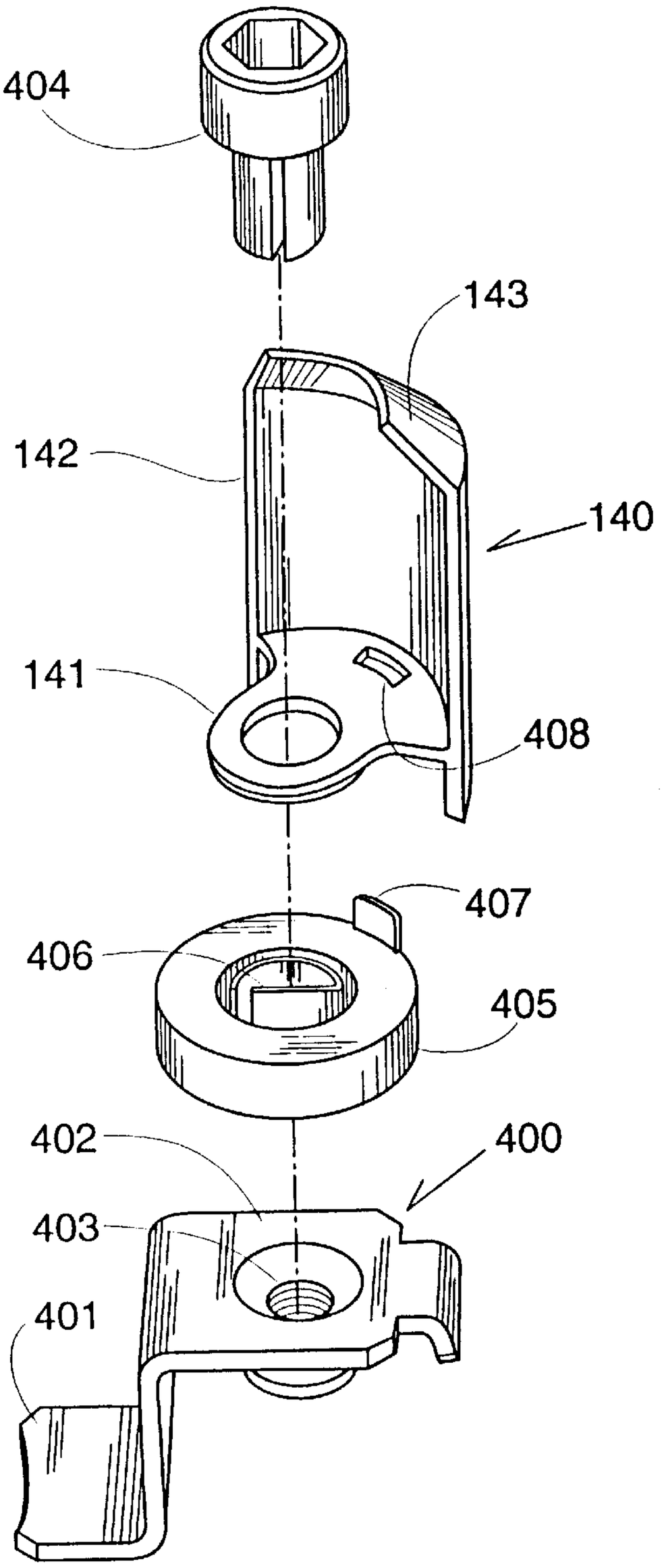


FIG. 11

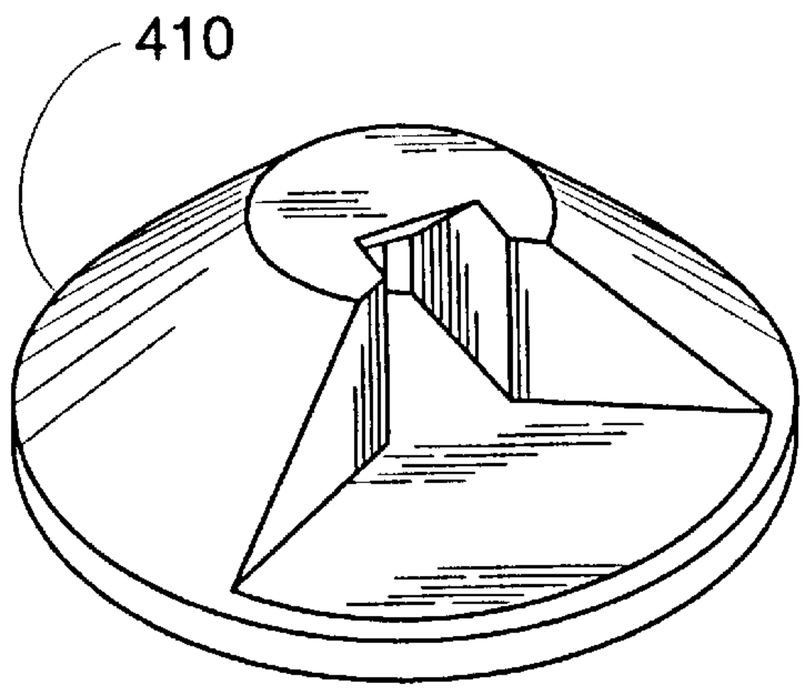


FIG. 14

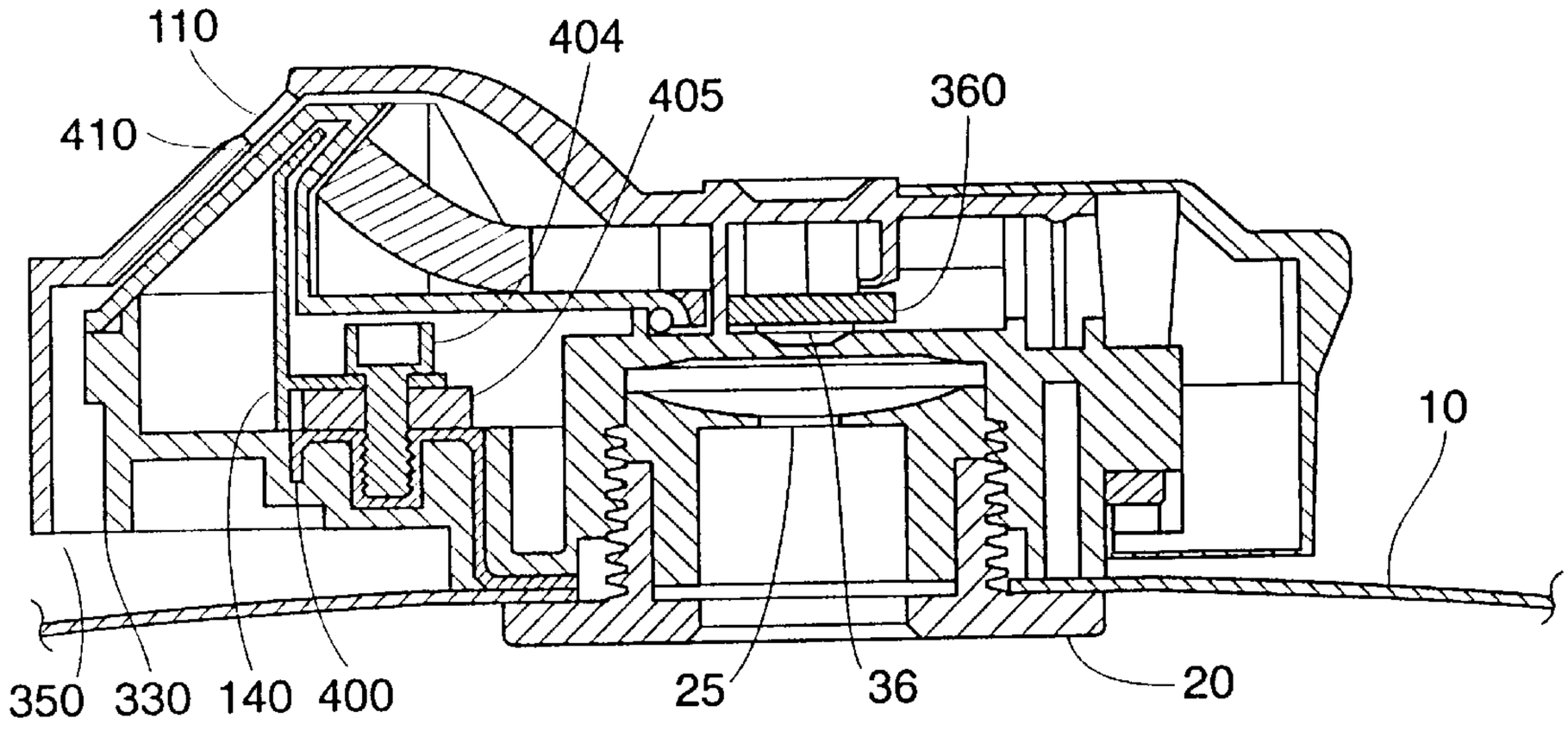

110
404
405
360
410
10
350
330
140
400
25
36
20

FIG. 12

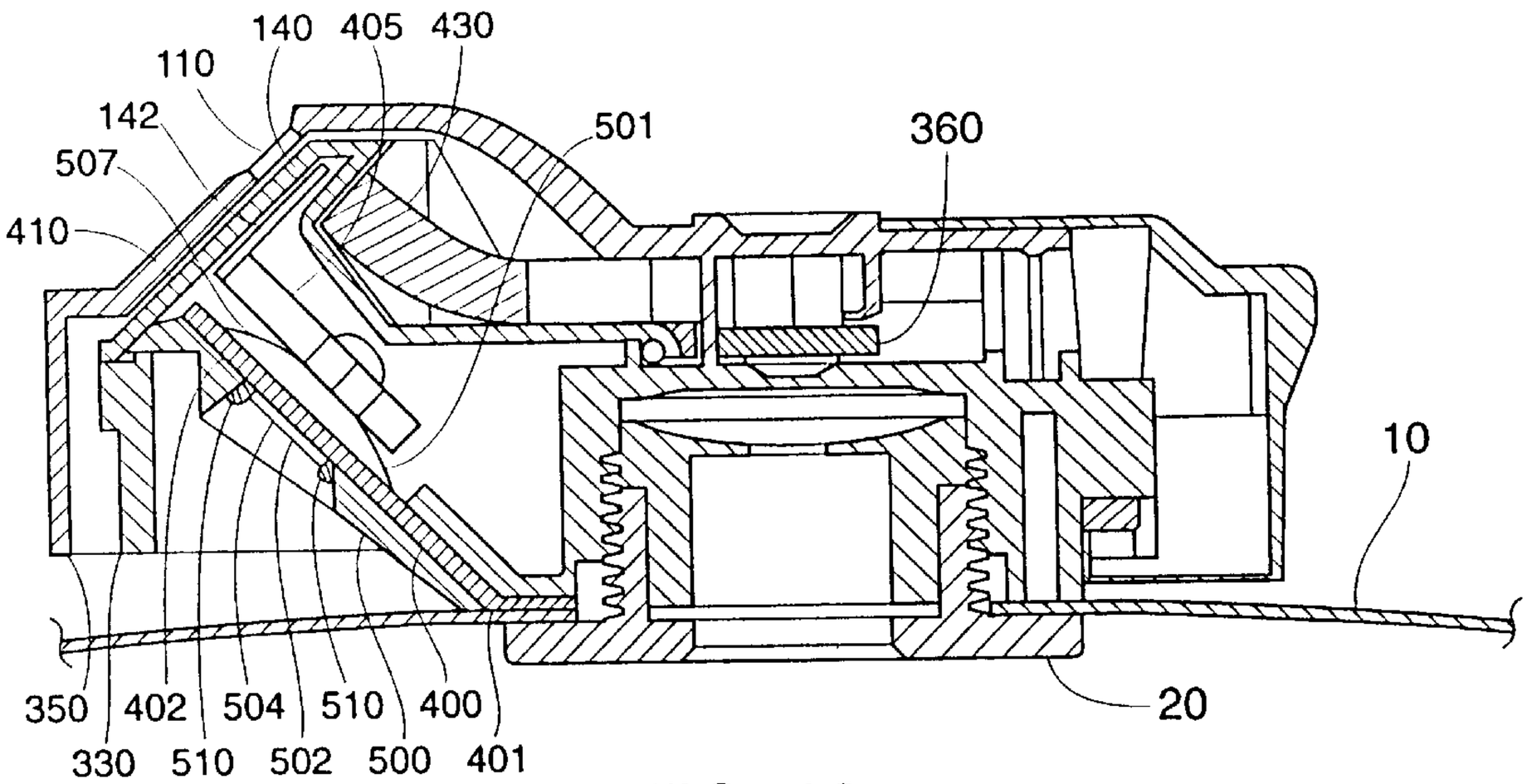

140
405
430
110
142
501
360
507
410
10
350
402
504
510
400
330
510
502
500
401
20

FIG. 13

TEMPERATURE INDICATING DEVICE FOR A COOKING VESSEL

This application claims benefit of provisional application Ser. No. 60/027,596 filed Oct. 4, 1996.

BACKGROUND OF THE INVENTION

The present invention relates generally to the field of cooking and more specifically to the use of accessory or integral devices which may be used to indicate the general temperature of the cooking vessel or the temperature of the material or food within the cooking vessel. Further, the present invention is believed to have particular application in the field of "Waterless" cooking especially in conjunction with devices which provide an audible signal.

"Waterless" cooking is old, as are knobs which give an audible signal when steam is formed to indicate attainment of cooking temperatures. Knobs for cooking vessels which are provided with whistles and having mechanisms to turn the whistle off or to allow the escape of steam are also known. Additionally, knobs with temperature indicating devices are also known. However, there is no system available to closely monitor the changes of temperature inside the cooking vessel, and to provide a combination of auditory and visual signals. While a whistling device may alert a cook when the temperature is high enough to start cooking, it offers no means to observe the variation of temperature inside the vessel during the cooking process. Cooking vessels retain a considerable amount of heat and it is desirable for the cook to have a visual reference to control the temperature inside the vessel. This is especially desirable where the cook may be hearing impaired or where the cook is engaging in "Waterless" cooking. Further, there is no teaching in the prior art of a structure for a cooking vessel that may be illuminated to enhance visual recognition of information, like temperature of the cooking vessel, for the user of the cooking vessel.

Accordingly, it is a goal of the present invention to provide both a structure and a method for supplying information about the temperature of the cooking vessel and the food in the cooking vessel in a visual manner.

It is a further goal of the present invention to provide a structure and method which relies on the use of light from a light source, traveling through a light tube or equivalent structure, to provide information to the user of the cooking vessel.

It is a further goal of the present invention to provide a structure and/or a method which may be used to illuminate the template or translucent panel or both to convey information regarding the temperature or cooking status of the cooking vessel or the material contained within the cooking vessel.

It is a further goal of the present invention to provide a structure and method which relies upon the use of both audible signals and visual signals to convey information regarding the temperature or cooking status of the cooking vessel or the material contained within the cooking vessel.

SUMMARY OF THE INVENTION

The present invention may be generally described as an illuminated accessory for a cooking vessel including a housing having at least one opening and an illumination means. The illumination means is coupled to the housing in such a manner as to permit the illumination means to illuminate the opening in the housing.

The present invention also frequently includes a temperature sensing element positioned between the opening and the illumination means. The temperature sensing element is intended for and is capable of indicating the temperature of the cooking vessel to which the illuminated accessory is mounted. Light from the illumination means improves the viewability of the temperature sensing element, making it easier to see through the opening in the housing.

The primary function of the illumination means is to improve the viewability of the temperature sensing element. The important requirement is that the illumination means provide sufficient light to fulfill this function. One structure designed to provide the requisite light is a light pipe disposed within the housing. The light pipe receives light through at least one opening in the housing and conducts this light by way of internal reflection to at least one other opening in the housing, the latter opening being the opening through which the temperature sensing element may be viewed. The light pipe may be fashioned from fiber optic material, acrylic material, polycarbonate material, or glass material.

Another illumination means intended to provide the requisite light is an electrically activated light source such as a light emitting diode or a light bulb mounted within the housing such that the opening through which the temperature sensing element is viewable is illuminated. The power needed to operate the light emitting diode or light bulb is provided by a plurality of solar collectors mounted on the housing.

Yet another illumination means includes a plurality of reflecting devices, e.g. mirrors, arranged within the housing about one or more openings in the housing so as to reflect the light entering the one or more openings to the opening in the housing through which the temperature sensing element is viewable.

The temperature sensing element is comprised of a heat sink, a bimetallic coil, and a substantially transparent template having means to indicate temperature printed thereon. The heat sink is embedded in the housing and is thermally coupled between the cooking vessel upon which the illuminated accessory is mounted and the bimetallic coil. The bimetallic coil is also mounted upon the heat sink. Heat conducted from the cooking vessel to the bimetallic coil makes the coil rotationally deflect. The magnitude of deflection of the bimetallic coil is know as a function of the temperature of the cooking vessel. The template is connected to the bimetallic coil such that the template rotates as a direct result of the rotational deflection of the coil. The rotation of the template brings the indicating means printed upon the template into position between the illumination means and the opening in the housing so as to relate to a user of the cooking vessel the temperature of the cooking vessel. The illumination means illuminates the template of the temperature sensing element, making it easier to see the template.

Another embodiment of the temperature sensing element requires a heat sink thermally coupled between the cooking vessel and a bimetallic coil, with the bimetallic coil also being mounted upon the heat sink. In this embodiment the indicating means are printed upon a transparent film that is affixed over an opening in the housing of the accessory. A pointer is coupled to the bimetallic coil in such a way that the rotational deflections of the coil cause the pointer to move across the opening having the indicating means affixed thereover. The pointer, driven by the bimetallic coil, indicates, by pointing to particular portions of the indicating

means, the temperature of the cooking vessel. The pointer is illuminated by the illumination means as the path the pointer travels is between the illumination means and the opening having the indicating means.

It is also intended that the accessory described herein may be configured to replace existing accessories for cooking vessels that do not incorporate an illumination means as also described herein.

It is also contemplated that prior art audible signal valve knobs for cooking vessels may be improved by incorporating therein illumination means and a temperature sensing element. In such an improved audible signal valve knob, an illumination means would be coupled to the housing of the knob so as to illuminate an opening in the housing. A temperature sensing element would be interposed between the opening and the illumination means so as to indicate the temperature of the cooking vessel upon which the knob is mounted. The temperature sensing element would be visible through the opening in the knob. The illumination means and the temperature sensing element described above, and their respective variations, are also suitable for use with an audible signal valve knob. Such an improved knob may also be configured for use as a replacement for prior art knobs not incorporating an illumination means or temperature sensing element.

It is also contemplated that a prior art audible signal valve knob for use with a cooking vessel might be improved by incorporating therein a temperature sensing element for indicating the temperature of the cooking vessel upon which the audible signal valve knob is mounted. The temperature sensing element and its variations described above are suitable for incorporation into a prior art audible signal valve knob. As is the case above, an improved audible signal valve knob incorporating the temperature sensing element may be configured to replace prior art knobs not incorporating a temperature sensing element.

The basic method of cooking using a cooking vessel having a temperature indicating device or apparatus is relatively simple. Heat is applied to a cooking vessel having an audible signal valve knob incorporating a temperature indicating device or apparatus or a knob for a cooking vessel comprising only a temperature indicating device or apparatus. The temperature indicating device and more particularly, the temperature sensing element, is observed to determine the temperature of the cooking vessel and its contents. The heat being applied to the cooking vessel is reduced or increased according to the observed temperature of the cooking vessel as derived from the temperature sensing element of the temperature indicating device.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a cross-sectional view of the present invention showing the light tube and heat sensing structures.

FIG. **2** is an exploded view of a prior art audible signal valve.

FIG. **2A** is an exploded view of the prior art audible signal valve showing the present invention incorporated into its structure.

FIG. **3** is a perspective view of the present invention as a separate add on structure for use with a knob for a cooking vessel.

FIG. **4** is a perspective view of an alternative structure of the present invention for use as a separate add on structure for use with an audible signal valve knob for a cooking vessel.

FIG. **5** illustrates another alternative structure of the present invention showing the present invention integral to an audible signal valve knob. However, it should be noted that the structure of the present invention could also be made integral to the knob of a standard cooking vessel.

FIG. **6** is a top perspective view of an alternate embodiment of the temperature indicating device.

FIG. **7** is a bottom perspective view of the underside of the alternate embodiment of FIG. **6**.

FIG. **8** is a top perspective view of the alternate embodiment with the cover removed.

FIG. **9** is an exploded view of the temperature indicating device showing the alternate version of the invention incorporated into its cooperating structure.

FIG. **9A** is an exploded view of the temperature indicating device showing an alternate embodiment light source, seen as a light bulb and power source, incorporated into its cooperating structure.

FIG. **9B** is an exploded view of the temperature indicating device showing another alternate embodiment light source, seen as a light emitting diode and power source, incorporated into its cooperating structure.

FIG. **10** is an enlarged view of the cantilever slide utilized in the alternate embodiment and particularly for use during waterless cooking.

FIG. **11** is an exploded view of an improved temperature indicating device having particular application to the alternate embodiment.

FIG. **12** is a cross sectional view of an assembly of the improved temperature sensing element mounted on top of a cooking vessel.

FIG. **13** is a cross sectional view of an assembly of another alternate embodiment featuring a specific configuration of the light illuminating template.

FIG. **14** is an enlarged perspective view of the transparent top.

DETAILED DESCRIPTION

Although the disclosure hereof is detailed and exact to enable those skilled in the art to practice the invention, the physical embodiments herein disclosed merely exemplify the invention which may be embodied in other specific structure. While the preferred embodiment has been described, the details may be changed without departing from the invention, which is defined by the claims.

It should be emphasized that the present invention **100** which is disclosed herein may be used in a variety of different ways with various cooking vessel structures including use as a separate add on device, a device integral to the structure of a cooking vessel, and as an interchangeable component with a cooking vessel. The use of the present invention **100** is not to be limited by the specific disclosure herein.

First, referring to FIG. **2**, a prior art audible signal valve which the present invention **100** may be used in combination with is disclosed and described. The top of a cooking vessel **10** is provided with a non-circular opening **12** to which the various parts of the knob of the present invention are mounted. This consists of an inner knob or knob base **20**, an outer knob **30**, a knob cover **50**, a valve slide **60**, and a leaf spring **70**.

The knob base, or inner knob **20** consists of a lower flange **21**, a hexagonal portion **22** to complementarily fit the opening **12** in the vessel **10**, which could be any appropriate,

preferably non-circular, shape, a threaded portion **23** and lower resonance chamber portion **24** surrounding a whistle orifice **25** having a form suited to generate a tone when a vapor passes through it.

Outer knob **30** consists of an inner skirt **31** adapted to screw on to threaded portion **23** of the lower knob, an outer skirt **32** which bears on the vessel **10** when outer knob portion **30** is screwed into place, a horizontal valve supporting surface **33**, resonance chamber side wall **34** and resonance chamber upper wall **35**, in the center of the resonance chamber upper wall a second whistle orifice **36** directly above the first orifice **25** in the assembled position, an orifice-surrounding boss **37**, slide stop abutments **38**, slide guide abutments **39** and guide bar abutment **40**. At diametrically opposite portions of valve supporting surface **33**, the outer knob **30** is provided with slight projections **31**, each provided with a depending tab **42** which underlies the slide valve path and becomes part of the knob cover **50**, which aligns it for non-rotatable assembly by means of screws **43**. The knob cover **50** is provided with a depending skirt **51** extending entirely around the knob and enclosing it with the exception of relieved portions **52** the size of depending tabs **42** of the upper knob, so that when the knob cover **50** is placed onto the upper knob body it is automatically aligned to receive screws **43** which secure the upper knob body to the knob cover **50** through holes **44**. Knob cover **50** has an orifice **53** in the center of the upper wall **54** and aligned with orifices **25** and **36**. Knob cover **50** also has studs **55** (not shown) depending from the underside of its upper wall **54** within the margin of skirt **51** to receive screws **43** and to assist in locating leaf spring **70**. Relieved portions **52** in skirt **51**, in addition to forming keys to receive tabs **42** for non-rotatable alignment, also serve in their upper portions as part of the valve slide path. Ends of the valve slide means **60** project therefrom so that they may be manipulated, as will be described later.

Valve slide **60** rests on boss **37** and is moveable along a valve slide means path extending from one surface extension **41** to the opposite projection **41** between slide stop abutments **38** and slide guide abutments **39** and guide bar abutment **40**, along a chord of the knob, preferably a diameter.

Valve slide means **60** consists of an asymmetric valve member having a pair of long sides **62** and a pair of ends **63**. One of the long sides **62** is provided with a pair of sidewardly extending abutments **64** which are spaced apart a distance along the slide valve path which is sufficiently less than the distance between the slide stop abutments **38**, in the same direction to permit whistle orifice **65** to be moved in the direction of the valve slide path to a first position over orifice **36** and to a second position completely unaligned with orifice **36**. For that purpose, it is preferable that orifice **65** not be in the exact center of rectangular body **61** but be spaced slightly from the center in the direction parallel to long sides **62** and to the valve slide path.

Leaf spring **70** is a generally rectangular member made of any suitably resilient and heat resistant material such as spring stainless steel. It has a depressed central portion **71**, a raised wing **72** at each end, forked ends **74** in each wing to locate spring **70** between the studs **55** depending from knob cover **50**, and a central orifice **76** positioned coaxially of orifices **25**, **36**, and **53** when the knob is assembled. The leaf spring **70** biases valve slide means **60** away from upper wall **54** into engagement with boss **37**, so that the valve slide **60** is always biased into good contact with the boss **37** and provides an effective seal, whether the valve is opened or closed. The exact amount of bias can be varied by changing the dimensions or material of leaf spring **70**; the bias should be sufficient to create a seal and maintain the selected position of slide **60**, but not so great as to distort the valve slide **60** or prevent the slide **60** from being operated to open or close the valve.

Thus, in the present embodiment valve means are defined by valve supporting surface **33**, whistle orifice **36**, boss **37**, valve slide means **60** and the parts **62–65** thereof, and leaf spring **70** bearing between upper wall **54** and valve slide means **60**. These parts cooperate together to regulate the flow of a fluid such as air between whistle orifice **36** and the exterior of the knob according to the position of valve slide means **60** in the previously defined valve slide path.

When the present knob is assembled as shown in FIG. **2**, one of the ends **63** of valve slide means **60** will project through one of the relieved portions **52** in knob cover **50** and will preferably bear a legend indicating whether the valve is open or closed. It may be slide along the valve path by finger pressure on the exposed end **63** to push that end flush with knob skirt **51** and expose the other end **63**, thereby opening or closing the valve. The valve construction described is simply made, readily cleaned and reassembled and keeps the fingers of the user away from escaping steam, unlike earlier structures.

As a whistle, the knob presents a series of orifices **25**, **36**, **65**, **76**, and **53** separated by a resonance chamber consisting of a lower resonance chamber **24** in the knob base **20**, and resonance chamber side wall **34** and resonance chamber wall **35** in the outer knob **30**, which form a very effective whistle. The remaining three orifices are not a part of the whistle, as such, but provide a valve end and escape path respectively. When food is being heated in vessel **10**, a temperature is reached at which substantial quantities of water vapor are generated and rushed through orifices **25** and **36** and the intervening resonance chamber, creating a whistling sound to warn the cook that the temperature should now be reduced for effective waterless cooking. The valve slide **60** is then moved from the open position to its closed position in which orifice **65** is displaced with respect to orifice **36**, by pushing on the projecting end **63** of the valve slide **60** which is at the left in FIG. **5** until the other abutment **64** strikes the corresponding slide stop abutment **38**. The top of vessel **10** in which the knob is located is now completely sealed and will retain the vapor within the pan to seal in the flavors and moisture. This method of cooking is well-known.

However, the presence of the whistle orifices and resonance chamber in the present knob offer the possibility of contamination by volatile food substances, or even, if the conditions are wrong, by solids passing through orifice **25**. In any case, it is desirable to be able to attain complete cleanliness in the knob. By removing the entire outer knob **30**, leaf spring **70**, slide **60**, and knob cover **50**, by unscrewing them from knob base **20**, the knob may be removed from vessel **10**. It will be noted that although pressure can be applied only to knob cover **50**, the reliefs **52** serve to prevent relative rotation, as do screws **43**, and apply the pressure to tabs **42** of the upper knob body, carrying it along as the cover **50** is rotated. Because opening **12** is preferably non-circular, and because the complementary (non-circular) hexagonal portion **22** of the lower knob body fits within it, it is easy to turn the upper portion while the lower portion remains stationary. The only remaining step to completely disassemble the knob, if that is necessary, is to remove the two screws **43**. These have been exposed once the outer parts of the knobs are removed, but are concealed by insulative plastic when the knob is assembled.

From a consideration of FIG. **2** it will be seen that the valve slide **60** can only be placed on the outer knob **30** in a

functional position with the words visible and the abutment **64** disposed adjacent and between slide stop abutments **38** to limit the travel of valve slide means **60** as indicated previously. Stops **38** have a space between them to receive abutment **64** but because of guide bar abutment **40** there is no comparable space between slide guide abutments **39**. When the slide **60** and leaf spring **70** are in place on outer knob **30**, knob cover **50** is placed over them, being guided by tabs **42** and reliefs **52** into position so that screws **43** are perfectly aligned for insertion. With screws **43** in place, the entire outer part of the knob is unitary. The knob base **20** may then be inserted in vessel **10** through opening **12** and the outer knob parts screwed on to threads **23**, whereupon skirt **32** bears on vessel **10** above flange **21** to give a very secure anchorage.

The improvement of the present invention, a temperature-indicating device, herein referred to as **100**, is shown in FIGS. **2**A and **3** through **14**. Referring to FIGS. **1** and **2**A, the outer knob **30** further includes an opening **160**. The opening **160** is situated between the hole **44** and the slide guide abutment **39**. The knob cover **50** further includes a first opening **120**, located in the upper wall **54** of the knob cover **50**, and a second opening **110** formed in the depending skirt **51**. The device **100** includes a light tube **130** having one end **132** arranged to be received in the opening **120** of the knob cover **50**, and the other end **134** located adjacent to the opening **110**.

After passing through opening **120**, the light tube **130** extends arcuately toward the depending skirt **51** in the direction of the opening **110**. The light tube **130** is positioned inside the knob cover **50** in a space defined by the skirt **51**, the upper wall **54**, the valve slide **60**, and the outer knob **30**. The positioning of the light tube **130** offers good light reception and does not interfere with the movement of the valve slide **60**.

The device **100** further includes a template **140** located adjacent to the skirt **51** and to the opening **110**. Preferably, the template **140** has a rectangular shape, but could be of any appropriate shape. The template **140** is interposed between the end **134** of the light tube **130** and the opening **110**. The template **140** incorporates the letters L, M, and H, which face the opening **110** of the knob cover **50** and correspond to low, medium, or high temperatures in the cooking vessel **10**, respectively. The template **140** may be designed to communicate any type of information desired such as a message or a temperature. The template **140** is moveably coupled to a temperature sensing element **150** able to move inside the knob cover **50**. The temperature sensing element **150** preferably consists of a bimetallic coil, sensing to temperature variations, having one end **152** moveably coupled to the template **140** and the other end **154** extending through the opening **160** in the outer knob **30** and coupled to the top of the cooking vessel **10**.

In the present embodiment, the improvement of the present invention provides an additional means for indicating the temperature inside a cooking vessel besides the well-known audible signal. When food is being heated in a vessel having a lid **10**, the temperature sensing element **150** senses the variation of temperature inside the cooking vessel cover **10**, activating the template **140**. The temperature variation of the cooking vessel cover **10** is directly related to the temperature variation within the cooking vessel. The movement of the template **140** is calculated to bring the letter corresponding to the temperature, or any other message relating to it, adjacent to the opening **110** of the knob cover **50**. The light rays enter the light tube **130** through the opening **120** in the upper wall **54** and travel toward the end **134**, projecting a focused light beam on the surface of the template **140**. Because the template **140** is generally transparent, the letter or the message is illuminated and will be visible from the outside through the opening **110**. The cook will know at any time the temperature inside the cooking vessel **10**.

Referring now to FIG. **3** the present invention **100** may seen used in conjunction with a standard knob **200** for a cooking vessel. In this embodiment the invention **100** is shown mounted to the side of the knob **200**. The invention **100** may be integral to the knob **200** or may be an add on feature designed to be coupled to the knob **200**.

Referring now to FIGS. **4** and **5** the present invention may be seen in two alternative embodiments for use with an audible signal valve knob **50**. Again the present invention may be used either as an integral component of the knob **50** or as an add on feature designed to be coupled to the knob **50**.

It should also be noted that the light tube **130** may be made out of any material that may sufficiently conduct light. Such materials include fiber optic strands and/or light conducting acrylics, for example, a General Electric Plastics light conducting acrylic. However, the presently preferred material for the light tube is a light conducting acrylic which may be bent or shaped mechanically upon heating the material to a temperature of approximately 100 degrees Fahrenheit. However, given the fact that the present invention **100** may be used on cooking vessels of a variety of configuration it should be understood that other light conducting materials, e.g., LEXAN or other polycarbonates or glass or other materials, having a higher range of heat resistance to deformation may be used.

A preferred embodiment of the temperature indicating device **100** has been adapted to be incorporated within a knob for a cover of a cooking vessel **10** that may embody means for producing an audible signal and for waterless cooking or their equivalents such as the means described in the U.S. Pat. No. 4,418,637, hereby incorporated by reference. This preferred embodiment of the temperature indicating device **100** may likewise be incorporated into a knob not provided with waterless cooking means.

The housing of the knob, including waterless cooking means as indicated above and as illustrated in FIGS. **6** through **14**, is comprised of a modified outer knob **330** removably coupled to a modified knob cover **350**. The outer knob **330** and the knob cover **350** are secured to a cover **10** for a cooking vessel by a standard knob base **20**, similar to the knob base **20** of U.S. Pat. No. 4,418,637. By utilizing the prior art knob base design, the improved knob incorporating the temperature indicating device **100** can replace existing knobs already in use that do not have the temperature indicating device **100**, in addition to being included as original equipment on new cooking vessel covers **10**.

As can be seen in FIG. **9**, the knob base **20** threadedly mates with the outer knob **330**, thereby capturing the cover **10** between the knob base **20** and the outer knob **330**, securing the outer knob **330** to the cover **10** of the cooking vessel, and completing the resonance chamber above the whistle orifice **25**. The resonance chamber and the whistle orifice **25** are the means whereby the knob can generate an audible tone. An audible tone is generated when steam exits the cooking vessel **10** through the whistle orifice **25** of the knob base **20**, the second whistle orifice **36** of the outer knob **330** (FIG. **8**), and finally through orifice **53** of the knob cover **350** (FIG. **7**). The whistle orifice **25** the second whistle orifice **36**, and the orifice **53** in the knob cover **350** are concentric with each other.

To hold the knob cover **350** to the outer knob **330**, the knob cover **350** is provided with a pair of clips **380** (FIG. **7**) that mate with a pair of latches **381** (FIG. **8**) formed into the outer knob **330**. Alternatively, screws may be used which pass through apertures formed in cover **350** and threadedly engaged into bosses formed in outer knob **330**. As the knob cover **350** is generally attached to the outer knob **330** before the outer knob **330** is threadedly mated to the knob base **20**, the outer knob **330** has been provided with three ribs **390** that radially extend outwardly from body of the outer knob **330**. The ribs **390** are arranged to be received by three slots **391**, formed from three pairs of parallel ribs, each similar to ribs **390**, extending radially inwardly from the inner surface of the depending skirt **51** of the knob cover **350**. When the knob cover **350** is secured to the outer knob **330** by the clips **380**, the ribs **390** are received by slots **391**, thereby providing a means to resist the torque that is applied when the knob base **20** is screwed into the outer knob **330** and preventing the clips **380** from being broken in the assembly operation. The clips **380** are designed to be releasable so that the knob cover **350** can be disassembled from the outer knob **330** if so desired.

In addition to means for generating an audible tone, means for engaging in waterless cooking are also provided in the present invention. In order to facilitate waterless cooking, a cantilever slide **360** (FIGS. **6** and **10**) is provided within the knob cover **350** so as permit the closure of the second whistle orifice **36** when the contents of the cooking vessel have reached a desired temperature. The cantilever slide **360** is intended to function in the same manner as slide **60** (FIGS. **2** and **2**A), described above. The cantilever slide **360** pivots freely about a pin **361** (FIG. **7**), formed into the underside of the knob cover **350**. The slide **360** extends from the pin **361** through a slot **356** in the depending skirt **51** of the knob cover **350** and terminates in a control surface **362** for manipulating the slide **360**. The slide **360** is shaped in a dogleg fashion such that a protuberance **363** (FIG. **10**) extending from the bent portion of the slide **360** will cover the second whistle orifice **36** in an airtight fashion when the slide **360** is in a first closed position, and will leave the second whistle orifice **36** open when the slide is in a second, open position. In order to aid the formation of an airtight seal between slide **360** and the second whistle orifice **36**, the knob cover **350** and the outer knob **330** are provided with a series of cooperating wedges **357** (FIGS. **7** and **8**) that impinge upon the sides of the slide **360** and bias it so that the protuberance **363** comes into sealing contact with the second whistle orifice **36** when the slide **360** is in a closed position. The slide **360** is opened or closed in accordance to the well known principles of waterless cooking.

In this embodiment and now referring to FIG. **11**, the temperature sensing element **150** may be comprised of a heat sink **400** that conducts heat energy from the cover **10** to a template **140** for indicating temperature. The heat sink **400** is fashioned of a thin piece of brass or other material similarly conductive to heat and is encased within the body of the outer knob **330** when the outer knob **330** is cast. The heat sink **400** is cast within the outer knob **330** in such a manner that heat may be conducted from the cover through the body of the outer knob **330** without providing a pathway for air or steam to pass through the body of the outer knob **330**. A first end **401** of the heat sink **400** is arranged so as to be in direct contact with the cover **10** of the cooking vessel. The other end **402** of the heat sink **400** has formed therein a threaded blind hole **403** that is sized so as to receive a slotted screw **404**. The slotted screw **404** has an axial slot running from the threaded end of the screw to near the cap of the screw. The slotted screw **404** is preferably of the same material as the heat sink **400**, in this embodiment brass. The second end **402** of the heat sink **400** may further be arranged to be substantially horizontal and flush with the upper surface of the outer knob **330**.

The template **140** is fashioned of a transparent material and is comprised of a tab **141** having a hole sized to freely receive the barrel of the slotted screw **404**, an upright portion **142** attached to the tab **141** that is essentially a radial section of a hollow cylinder. The radius of rotation of the template **140** is defined by the length of the tab **141** as measured from the center of the hole for receiving the slotted screw **404** to the upright portion **142**. The radius of the upright portion **142** is generally the same as the radius of rotation of the template **140**. Molded integral to the top of the upright portion **142** of the template **140** is an indicating portion **143** that is essentially a radial section of a hollow cone. The lower diameter of the indicating portion **143** is the same as and coextensive with the diameter of the upright portion **142** and the upper diameter of the indicating portion **143** is somewhat smaller than that of the lower diameter of the indicating portion **143**. The indicating portion **143** of the template **140** incorporates the letters L, M, and H (FIG. **8**). These letters are intended to indicate the temperature within the cooking vessel, though other means of indicating the temperature within the cooking vessel may be used. Examples of alternate means include various color spots (blue for cold, green for medium, and red for hot), numbers indicating the temperature, or a graduated ramp indicating rising temperatures. These examples are given by way of illustration only and do not constitute a comprehensive list of indicating means that may be used with the template **140**.

An assembled temperature sensing element **150** has the slotted screw **404** rotatably received in the hole in the tab **141** of the template **140**. The bimetallic coil **405** is mounted upon the slotted screw **404** immediately adjacent to the tab **141** of the template **140**. The bimetallic coil **405** is of a well know configuration and has at its center a projection **406** arranged to be received in the slot of the slotted screw **404**. When the projection of the bimetallic coil **405** is received in the slot of the slotted screw **404**, the coil **405** will be circumjacent to the screw **404**. A second projection **407** is located at the outer edge of the bimetallic coil **404**. This second projection is arranged to mate with a notch **408** in the tab **141** of the template **140** such that when the temperature of the coil **405** changes, the template will be constrained to rotate about the slotted screw **404** in direct relation to the temperature induced deflections set up in the coil **405**. Having assembled the screw **404**, template **140**, and coil **405**, the screw **404** is threaded into the threaded blind hole **403** of the heat sink **400**. The screw **404** is threaded into the hole **403** to a point where the template **140** and coil **405** are securely retained and such that the template **140** is in a calibrated position to accurately indicate the temperature. This calibrated position is further defined by an opening **110** formed in the knob cover **350**. In order to function, the indicating portion **143** of the template **140** must be immediately adjacent the opening **110** and must present the proper letter or other indicating means to the opening **110** to indicate the actual temperature present within the cooking vessel.

In order to protect the temperature sensing element **150** from corrosion caused by moisture and to prevent the buildup of food substances, a transparent top **410** (FIGS. **9** and **12–14**) is fitted over the temperature sensing element **150**. Since the temperature indicating device **100** is offset

from the waterless cooking means in the knob, the top **410** does not interfere in any way with the functioning of the waterless cooking means. The top **410** is sealed to the outer knob **330** in an airtight manner. The top **410** is also structured so not as to interfere with the rotation of the template **140**. The transparency of the top **410** permits the indicating means of the indicating portion **143** to be viewed clearly through the opening **110**.

Furthermore, the structure of the top **410** is such that a light means can be mounted immediately behind the indicating means on the template **140**, directly across from the opening **110**. In this embodiment, the light means is a Y-shaped light pipe **430** (FIG. **9** and **12–13**) that conducts light from two openings **120***a* and **120***b* formed into the knob cover **350** adjacent the orifice **53**. Light entering the openings **120***a* and **120***b* enters the light pipe **430** at first and second collection ends **431** and **432**. By means of internal reflection, this light is transmitted to the output end **433** of the light pipe **430**. Since the output end **433** of the light pipe **430** is located immediately behind the indicating means of the template **140**, light exiting the light pipe **430** at the output end **433** passes through the indicating means of the template **140** and exits the knob at opening **110**, thereby illuminating the indicating means of the template **140**. The "Y" shape of the light pipe **430** of this embodiment allows for the conduction of more light than would a tubular light pipe such as the light pipe **130** of FIG. **1**. The Y-shaped light pipe **430** will also continue to illuminate the template **140** if one of the openings **120***a* or **120***b* becomes occluded. In order to secure the light pipe **430** in its proper location during assembly, a small circular blind hole **434** (not shown) is molded into one leg of the light pipe **430** such that a hexagonal or octagonal post **435** formed integral to the outer knob **330** can be frictionally received by the hole **434**. This hole **434** is carefully located so as not to interfere with the internal reflection necessary to transmit light through the light pipe **430**.

While the Y-shaped light pipe **430** described above is preferred in this embodiment, it should be understood that other means for illuminating the template **140** could be utilized without straying from the invention herein defined. An alternate means that can be employed to illuminate the template **140** is a light emitting diode (LED) **430***b* and seen generally in FIG. **9**B or as seen in FIG. **9**A, other electrically operated illumination device such as a light bulb, **430***a* coupled to a plurality of solar collectors fastened to the exterior of the upper wall **54** of the knob cover **350**. The LED **430***b* or other electric illumination device would be mounted to the top **410** immediately opposite the opening **110** in the knob cover **350** so as to illuminate template **140**.

Another alternate means for illuminating the template **140** would be to use a plurality of mirrors that would be arranged about a suitable configuration of openings in the knob cover **350** so as to direct ambient light towards the opening **110**. The light passing out of opening **110** would first pass through the template **140**, thereby illuminating it and increasing its visibility through the opening **110**. The description of these two alternate means for illuminating the template **140** are given by way of example only and are not to be construed as a complete listing of alternate illuminate means.

An alternate and preferred embodiment of the temperature sensing element **150** (FIG. **13**) is also disclosed below. In this preferred embodiment, the second end **402** of the heat sink **400** is formed to maintain an inclined position when molded within the outer knob **330**. In the first embodiment of the temperature sensing element **150** described above, the second end **402** of the heat sink **400** was maintained in a generally horizontal position and flush with the outer knob **330**. The slotted screw **404** was threaded through the heat sink **400** and into a blind hole **403** formed in the outer knob **330**. In this preferred method of arranging the heat sink, the outer knob **330** is molded with an inclined surface **500** having a through hole **501** formed therein. The heat sink **400** is fashioned so as to conform itself to the inclined surface **500** of the outer knob **350**. The heat sink **400** also has a hole formed therethrough that is concentric with the through hole **501** of the outer knob **330**. The slotted screw **404** of the above described embodiment is in this alternate and preferred embodiment replaced with a slotted pin **502** having a slot **503** (not shown) extending from the end of the barrel of the pin towards the cap **504** of the pin **502** for most of the length of the barrel of the pin **502**. The cap **504** of the pin **502** has a diametrically oriented groove **505** (not shown) arranged to accept a screwdriver or similar tool so that the orientation of the pin can be adjusted with regard to the outer knob **330** and more particularly, with regard to the opening **110**. Spaced away from the cap **504** of the pin **502** along the barrel of the pin is a circumferential groove **506** (not shown). The distance between the cap **504** and the circumferential groove **506** is at least as great as the thickness of the inclined surface **500**. The circumferential groove is arranged to receive a spring clip **507** when the slotted pin **502** is received by the through hole **501**. The pin **502** is to be inserted into the through hole **501** so that the barrel of the pin **502** and the circumferential groove **506** are located on the upper side of inclined surface **500**. The cap **504** is sized to prevent the pin **502** from being pulled through the through hole **501**. When the spring clip **507** is in place, the pin **502** is secured in the through hole **501** and is freely rotatable within the through hole **501**.

Once the pin **502** has been clipped into the through hole **501**, the bimetallic coil **405**, having the same configuration as the above described embodiment, is seated on the pin **502** with the center projection being received by the slot in the barrel of the pin **502**.

The template **140** of this embodiment is also modified. In this embodiment the template **140** may or may not have a tab **141**. The template **140** may be affixed directly to the bimetallic coil **404** or a tab **141** may be seated on the slotted pin **502** as described above. In either case, the template is constrained to rotate about the pin **502** in direct relation to the temperature induced rotational deflections of the bimetallic coil **404**. As can be seen in FIG. **13**, the template does not include an indicating portion **143**. Instead, the means for indicating temperature are incorporated on the upright portion **142** of the template **140**. The upright portion **142** of this embodiment of template **140** rotates essentially parallel to the transparent top **410**, with the temperature indicating means interposed between the light pipe **430** or other illuminating means and the opening **110** in the knob cover **350** and visible through opening **110**. Using the diametrical groove **505** in the cap **504** of the pin **502** and an appropriate tool such as a screwdriver, the template can be adjusted to a predetermined position calibrated to permit the template **140** to accurately represent the temperature inside the cooking vessel. Once the pin **502** has been rotated to its proper position, the cap **504** is locked into place using an appropriate heat resistant material such as an epoxy adhesive **510**. This inclined embodiment offers the benefits of simplifying the manufacture of components such as the template **140** which in this embodiment has fewer complex shapes, and making the calibration of the bimetallic coil **405** more certain by providing a means to positively secure the coil **405** in a particular calibrated position.

Yet another alternate embodiment of the temperature sensing element **150** is herein described. In this embodiment, the indicating means normally present upon template **140** are printed upon a transparent film which is placed over opening **110**. Light from the illuminating means, chosen from those illuminating means described above, illuminates the indicating means printed upon the transparent film no affixed over opening **110**. Furthermore, in this embodiment, the template **140** is omitted in favor of a slender pointer that may be rotationally mounted upon the slotted screw **404** or slotted pin **502** and actuated by the bimetallic coil as described above, or the pointer may be affixed directly to the second projection of the bimetallic coil **404**. The temperature sensing element **150** of this embodiment will be calibrated so that the pointer will be viewable through opening **110** and will point to the appropriate portion of the indicating means of opening **110** so as to indicate the temperature of the cooking vessel **10**.

The foregoing is considered as illustrative only of the principles of the invention. Furthermore, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described. While the preferred embodiment has been described, the details may be changed without departing from the invention, which is defined by the claims.

What is claimed is:

1. An illuminated accessory for a cooking vessel comprising:

a housing having at least one opening;

an illumination means coupled to said housing and arranged to illuminate said at least one opening; and

a temperature sensing element interposed between said illumination means and at least one opening such that said temperature sensing element is illuminated by said illumination means and is visible through said at least one opening, said temperature sensing element being capable of indicating the temperature of said cooking vessel.

2. The illuminated accessory for a cooking vessel of claim **1** wherein said illumination means comprises:

a light pipe disposed within said housing so as to receive light from at least one opening in said housing and conduct said light by means of internal reflection to at least one other opening in said housing such that said one other opening is illuminated by said light pipe.

3. The illuminated accessory for a cooking vessel of claim **1** wherein said electrically activated light source is selected from the group consisting of a light emitting diode and a light bulb.

4. The illuminated accessory for a cooking vessel of claim **1** wherein said temperature sensing element is comprised of:

a heat sink thermally coupled between said cooking vessel and a bimetallic coil such that said bimetallic coil will be rotationally deflected in a known relation to the temperature of said cooking vessel and

a substantially transparent template rotationally connected to said bimetallic coil such that said template rotates in direct relation to said rotational deflection of said bimetallic coil, said template further including indicating means from relating the temperature of said cooking vessel to a user of said cooking vessel, said template being arranged such that said indicating means are illuminated by said illumination means and viewable through said at least one opening.

5. The illuminated accessory for a cooking vessel of claim **1** wherein said temperature sensing element is comprised of:

a heat sink thermally coupled between said cooking vessel and a bimetallic coil such that said bimetallic coil will be rotationally deflected in a known relation to the temperature of said cooking vessel;

a transparent film having indicating means for relating the temperature of said cooking vessel to a user of said cooking vessel printed thereon, said transparent film being affixed over said at least one opening such that said indicating means are viewable in said at least on opening; and

a pointer coupled to said bimetallic coil, said pointer constrained to move in direct relation to said rotational deflection of said bimetallic coil, a free end of said pointer being arranged to move between said indicating means of said at least one opening and said illumination means, said free end of said pointer pointing to a portion of said indicating means indicative of the temperature of said cooking vessel, said free end of said pointer further being viewable in said at least one opening.

6. The illuminated accessory for a cooking vessel of claim **2** wherein said light pipe is comprised of one of a group consisting of fiber optic material, acrylic material, polycarbonate material, and glass material.

7. The illuminated accessory for a cooking vessel of claim **1** wherein said housing is configured to replace an existing accessory for a cooking vessel not incorporating an illumination means.

8. In an audible signal valve knob for a cooking vessel comprising means for generating an audible tone and means for engaging waterless cooking, the improvement comprising:

an illumination means coupled to a housing of said audible signal valve, said housing having at least one opening, said illumination means arranged to illuminate said at least one opening and

a temperature sensing element interposed between said illumination means and said at least one opening such that said temperature sensing element is illuminated by said illumination means and is visible through said at least one opening, said temperature sensing element being capable of indicating the temperature of said cooking vessel.

9. The improvement of claim **8** wherein said illumination means comprises:

a light pipe disposed within said housing so as to receive light from said at least one opening in said housing and conduct said light by means of internal reflection to at least one other opening in said housing such that said one other opening is illuminated by said light pipe.

10. The improvement of claim **8** wherein said electrically activated light source is selected from the group consisting of a light emitting diode and a light bulb.

11. The improvement of claim **8** wherein said temperature sensing element is comprised of:

a heat sink thermally coupled between said cooking vessel and a bimetallic coil such that said bimetallic coil will be rotationally deflected in relation to the temperature of said cooking vessel and

a substantially transparent template rotationally connected to said bimetallic coil such that said template rotates in direct relation to said rotational deflection of said bimetallic coil, said template further including indicating means from relating the temperature of said cooking vessel to a user of said cooking vessel, said template being arranged such that said indicating

means are illuminated by said illumination means and viewable through said at least one opening.

12. The improvement of claim **8** wherein said temperature sensing element is comprised of:

a heat sink thermally coupled between said cooking vessel and a bimetallic coil such that said bimetallic coil will be rotationally deflected in relation to the temperature of said cooking vessel;

a transparent film having indicating means for relating the temperature of said cooking vessel to a user of said cooking vessel printed thereon, said transparent film being affixed over said at least one opening such that said indicating means are viewable in said at least on opening; and

a pointer coupled to said bimetallic coil, said pointer constrained to move in direct relation to said rotational deflection of said bimetallic coil, a free end of said pointer being arranged to move between said indicating means of said at least one opening and said illumination means, said free end of said pointer pointing to a portion of said indicating means indicative of the temperature of said cooking vessel, said free end of said pointer further being viewable in said at least one opening.

13. The improvement of claim **9** wherein said light pipe is fabricated from a material selected from a group comprised of fiber optic material, acrylic material, polycarbonate material, and glass material.

14. The improved audible signal valve knob of claim **8** wherein said knob is configured to replace an existing accessory for a cooking vessel.

15. A process for monitoring the temperature of food in a cooking vessel having an audible signal valve knob comprising a knob base structure projecting through said cooking vessel, an outer knob structure abutting said cooking vessel and removably secured to said knob base structure, a knob cover structure removably secured to said outer knob structure and having an opening formed therein, and an illuminated temperature-indicating device, the process comprising:

applying heat to said cooking vessel;

observing the illuminated temperature-indicating device;

reducing the heat applied to said cooking vessel when said illuminated temperature-indicating device indicates a predetermined temperature range.

* * * * *